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Diffusion of Farm Tractor in India from 1960 to 2012: Patterns and Prospects

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Introduction

- India has one of the largest tractor industry in the world. On average, about 700,000 tractors are sold in India per annum with its market value of about USD 4 billion. The average tractor use in India is still lower by the world standard, and a huge disparity exists on its uses across states (regions) in the country.
- With a sharply declining trend in draft animal over the years, increased use of farm tractors (and machinery) is inevitable in India now to increase crop productivity, sustain farm households' income, and rural economic growth.



Tractor with a mobile oil expeller in a village in Haryana

Objectives

- To analyze pattern of growth of tractor uses at national level and across major states of India during the last four decades.
- To evaluate process, speed of diffusion, and ceiling of diffusion of tractors across various states.
- To assess the policy implications for efficient uses of the tractor technology by smallholding farmers in India.

Methodology and Data

- We have analyzed market size, growth patterns, and diffusion of tractor across 14 major states of India during the last four decades. This has been done using the diffusion study framework of Griliches (1957):

$$TD = \frac{K}{1 + e^{-(a+bt)}}$$

where:

TD = Tractor density (tractor per 1000 ha of Net Sown Area (NSA)).

K = Ceiling level of tractor density (model determined)

e = Exponential term

b = Rate of adoption of tractor in a place (slope)

a = Intercept value of the diffusion model

- Secondary data on tractors used are used published from national and state-level agencies of Government of India.

Results and Discussions

- The tractor use at all India level has increased exponentially after liberalization of tractor industry policy in 1992 (Fig. 1).
- The adoption and diffusion of tractors in India has been concentrated in Punjab and Haryana than in other states (Fig. 2).

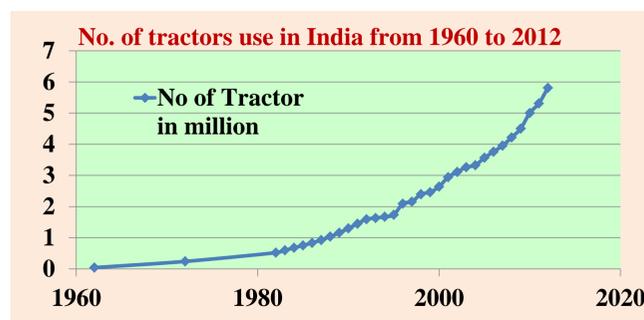


Fig. 1. Tractors growth at all India level, 1960 to 2012

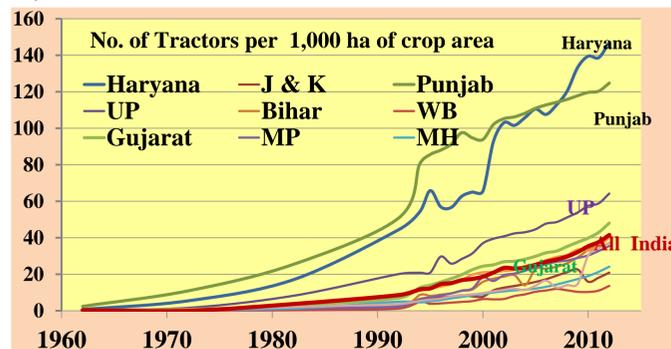


Fig. 2. Spread of tractors across states of India, 1962 - 2012. (Unit: Tractor No. per 1000 ha of Net Sown Area)

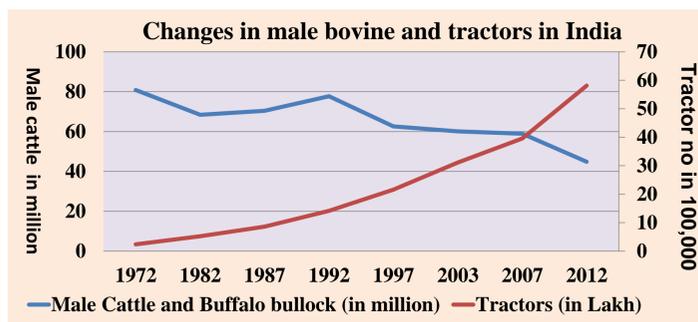


Fig. 3. Trend on male bovine and tractor use in India, 1972 to 2012

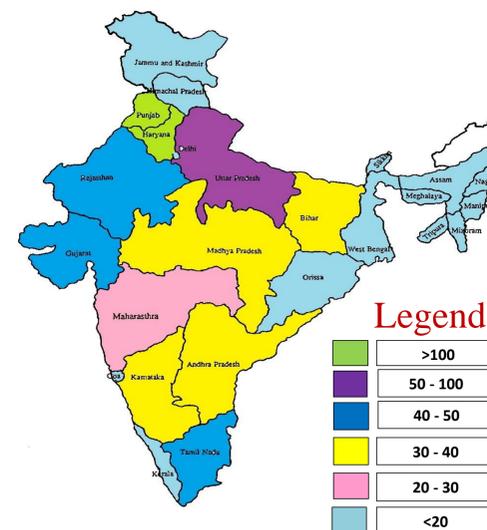


Fig.4. Tractor Intensity across states of India in 2012 (Unit: Tractor per 1000 ha of Net Sown Area)

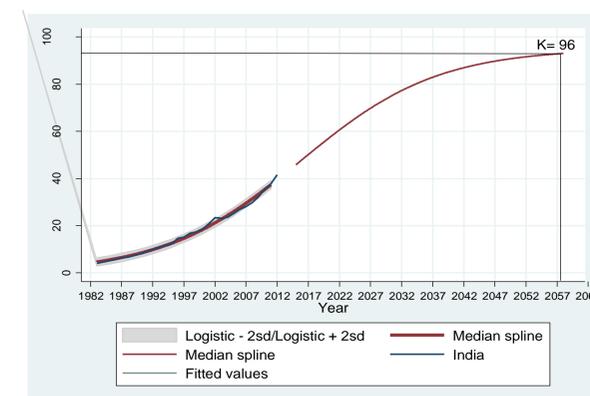


Fig. 5. The tractor diffusion curve for all India



Tractor being mounted on harvester for its power.

Table 1. Parameters of tractor diffusion curve across states of India, 1982-2012

States	Intercept (a)	Slope (b)	Ceiling (K)	Year associated with ceiling level	Tractor density in 2012
Haryana		0.09	232	2051	147
Punjab	-1.52	0.15	127	2025	125
Maharashtra	-4.35	0.10	100	2056	24
Uttar Pradesh	-2.52	0.10	98	2048	64
Gujarat	-3.03	0.13	62	2045	48
Rajasthan	-2.93	0.14	45	2036	40
Madhya Pradesh	-3.62	0.14	44	2047	32
West Bengal	-3.14	0.15	7.4	2030	7
Kerala	-2.05	0.11	7.0	2044	6
All India level	-3.16	0.09	96	2058	42

- The state-specific ceiling rate and slope of diffusion of tractors hugely vary across the states (Table 1).
- Tractor uses in India would continue to grow, and may stabilize when about 15 million tractor uses are there at all India level. There are huge variations on tractor intensity across the states of India (Fig. 2 and 4), ranging from 6 to 150 tractor density in 2012.

Conclusions and Implications

- Tractor penetration in large parts of India is still low, and with a huge disparity on its use across the states.
- Tractor uses have expanded tremendously after liberalization of its economy in early 1990s, and liberalization of the tractor industry policies.
- Tractor diffusions curve across the states and at all India level suggest that tractor uses will continue to grow in India even in the coming few decades, with a more widespread adoption across the states.

Reference

Singh, G. 2015. Agricultural Mechanization Development in India. Indian Journal of Agricultural Economics. 70(1): 64-82.

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